

REMARKS

Claims 1-16 and 28-32 are pending in the above referenced application and have been rejected by the examiner. Claim 28 has been cancelled. Claims 1, 29 and 30 have been amended. The following remarks are directed to the claims as amended.

Claims Rejections - 35 USC 102

Claim 1-6 and 9-15 stand rejected as being allegedly anticipated by Inaba (U.S. Pat. No. 6,093,644). Examiner's grounds for rejection are hereinafter traversed, and reconsideration is respectfully requested.

All of the limitations of the dependent Claim 28 have been incorporated into its base Claim 1, and the term "slip" has been further amended to the term "frictional slip". Accordingly, Inaba does not teach or suggest a wafer boat:

"wherein the wafer contact surface is less than or substantially equal to 1/2 of the surface area of the wafer."

Accordingly, for at least the reasons stated herein above, Claim 1 is patentable over Inaba. Additionally, Claims 2-6 and 9-15 should also be patentable over Inaba as variously depending from independent Claim 1.

Claims Rejections - 35 USC 103

A) Rejection of Claims 7 and 8

Claim 7 and 8 stand rejected as being allegedly unpatentable over Inaba in view of Lu (U.S. Pat. 6,093,644). Examiner's grounds for rejection are hereinafter traversed, and reconsideration is respectfully requested.

Claims 7 and 8 depend from Claim 1. Neither Lu or Inaba teach or suggest the following Claim 1 (and by dependency Claims 7 and 8) combination of elements of a wafer boat:

wherein the post coating surface finish of the wafer contact surface substantially prevents frictional slip in the silicon wafers and is less than or substantially equal to 1 micron; and

wherein the wafer contact surface is less than or substantially equal to 1/2 of the surface area of the wafer.

Moreover, Lu is completely devoid of any teaching or suggestion of the problem of any kind of slip damage to the crystal structure of the wafers. Accordingly, there is no incentive to combine the teachings of Lu and Inaba with regards to the issue of slip.

Accordingly, for at least the reasons stated herein above Claims 7 and 8 are patentable over Inaba in view of Lu.

B) Rejection of Claims 16 and 28-32

The original Claim 28 (now amended Claim 1) and Claims 29-32 stand rejected as being allegedly unpatentable over Inaba in view of Wingo (U.S. Pat. No. 6,171,400). Examiner's grounds for rejection are hereinafter traversed, and reconsideration is respectfully requested.

Discussion Of The Examiner's Burden To Establish A Prima Facie Case Of Obviousness Under 35 USC 103:

As clearly stated in MPEP 706.02(J), the burden is on the Examiner to establish a prima facie case of obviousness. In doing so, three basic criteria must be established by the Examiner:

"First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings."

"Second, there must be a reasonable expectation of success."

"Finally, the prior art reference (or references when combined) must teach or suggest all of the claimed limitations."

In other words, both the suggestion for combining teachings to make the invention and its reasonable likelihood of success must be found in the prior art. That various bits of data or teachings exist in the prior art is not enough for the examiner to overcome his burden of establishing a prima facie case of obviousness. There must be something in the prior art itself that suggests that those teachings could or should be combined.

This is further supported in MPEP 706.02(J) wherein it states that:

"The initial burden is on the examiner to provide some suggestion of the desirability of doing what the inventor has done. To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention would have been obvious in light of the teachings of the references."

In the present rejection, the Examiner has not established a prima facie case of obviousness because the above criteria have not been met. The Examiner's sole reasoning for combining the Wingo and Inaba references is found in the last sentence of page 3 of the Office Action where the Examiner states:

"Wingo discloses a support surface less than 1/2 of the wafer area while being cognizant of the importance of support area for prevention of slip (Abstract)."

However, as will be discussed in greater detail herein below, the slip discussed in the Wingo abstract and indeed throughout the Wingo patent is gravitational slip, which

is completely different and unrelated to the frictional slip disclosed in the Inaba patent. Moreover, Wingo is not concerned at all with surface area, but rather with providing "uniform support" for the wafers (see Wingo abstract, line 13). This is because Wingo is concerned only with the prevention of sagging (see Wingo abstract, line 16) of the wafers, i.e., the major cause of gravitational slip, rather than the prevention of scraping of the wafer across support surfaces, i.e., the major cause of frictional slip. Accordingly the Examiner has not properly established a proper grounds for combining the teachings of Wingo and Inaba.

Detailed Discussion Of No Suggestion Or Motivation To Combine Wingo And Inaba.

There is no suggestion or motivation to combine the teachings of Wingo and Inaba because they are directed to solving two distinctly different and unrelated types of problems. That is, Inaba is directed toward solving the problem of frictional slip and Wingo is directed toward solving the problem of gravitational slip. The Applicant has included with this Response, a memorandum from the inventor, Mr. Richard R. Hengst, explaining the distinct differences between gravitational slip and frictional slip. As summarized in the memorandum, gravitational slip is caused from:

"the stress induced to the wafer via the unsupported portion of the wafer", and

frictional slip is caused from:

"the stress induced via the sliding of the wafer across the support surface".

To prevent frictional slip the surface finish of the wafer contact area is critical. For that reason, Inaba discusses only surface finish as a solution to the problem of dealing with frictionally induced slip (see Inaba the abstract, column 2 lines 1-8, and column 2 lines 35-55). No other design criteria is discussed as contributing to the solution of frictional slip anywhere in the specification of Inaba.

In distinct contrast, however, the Wingo reference deals solely with the problem of gravitational slip. As stated in the inventor's memorandum:

"Gravitational stress (which induces slip) is not dependent upon the surface condition of the contact surface in the area of support".

In fact, any teaching or suggestion of the surface finish of the wafer contact surfaces in Wingo is completely absent. This is because the concept of "surface finish" is irrelevant with regards to the problem of gravitational slip. To emphasize this point, even if the surface finish of the contact surfaces in Wingo were made idealistically infinitely smooth, there will still be gravitational slip induced into the wafers if they are not properly supported. For that reason, Wingo discusses only the geometric shape and position of the support structures 30 relative to the wafers in an attempt to provide the uniform support required to solve the problem of gravitationally induced slip (see Wingo, column 4 lines 46-62). In other words, Wingo is attempting to balance the wafers on the support structures such that the cantilevered unsupported sections of the wafers counterbalance each other, and do not sag during high temperature operations. Wingo simply does not care about the surface finish of the support structures 30.

Accordingly, since the Wingo and Inaba patents are concerned with two totally separate problems, they are completely absent of any suggestion or motivation to combine teachings and the Examiner has not established a prima facie case of obviousness.

"Teaching Away" vs "Motivation To Combine".

It is the Applicant's distinct impression that the Examiner believes the burden of establishing a "motivation to combine" can be met unless there is strong evidence not to combine the references. In other words, the references must "teach away" from each other in order to prevent the Examiner from establishing a prima facie case to combine references. If the Applicant's impression is correct, than with all due respect, the Applicant strongly disagrees with the Examiner. The above interpretation is simply not the law.

The concept of the "motivation to combine" and the concept of "teaching away" are not one and the same. "Motivation to combine", is the first criteria required to establish a prima facie case of obviousness as listed under MPEP 706.02(J):

"First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings."

The above clearly asserts that the mere absence of any suggestion or motivation to combine is enough to prevent the Examiner from establishing a prima facie case to combine references.

Conversely, a prior art reference that diverges from and points in a technical direction away from the present invention is evidence that the present invention is nonobvious and hence patentable. That a reference "teaches away" is evidence that strengthens the assertion of no "motivation to combine". However, the Examiner's burden of establishing that references must show a "motivation to combine" is not replaceable by a new and lesser burden of establishing that the references do "not teach away".

To interpret the Examiner's threshold criteria of establishing a "motivation to combine" as being fulfilled if there is simply no strong evidence of teaching away would effectively eliminate that criteria. In other words, an Examiner would be able to establish a prima facie case of obviousness simply by taking various bits of data or teachings that exist anywhere in the prior art, regardless of how unrelated the prior art is, so long as the references do not expressly or impliedly teach away from each other. The Examiner would not have to concern himself with whether or not the references showed an actual motivation to combine.

The above interpretation would be reducing the burden of establishing a prima facie case of obviousness in a way not supported in the MPEP, statutes, regulations, case law, or anywhere else for that matter. However, if the Examiner is not persuaded by

Applicant's reasoning, than the Applicant respectfully requests that the Examiner point out where there is support in the MPEP, law or regulations for the interpretation that the "motivation to combine" criteria is one and the same as a criteria of not "teaching away".

Summary

In summary, there is no such suggestion or motivation to combine the Wingo and Inaba references and the Examiner has not establish a prima facie case of obviousness. Accordingly, for at least the reasons stated herein above, Claims 1 and 29-32 are patentable over Inaba in view of Wingo and in condition for allowance. Additionally, Claims 2-16 should now be allowable as variously depending from what should now be an allowable independent Claim 1.

However, if the Examiner is not persuaded by Applicant's reasoning, than the Applicant respectfully requests that the Examiner point out where the motivation to combine exists in the references. Specifically, the Applicant requests that the Examiner point out where the problem of frictional slip is discussed in Wingo, and where the problem of gravitational slip is discussed in Inaba, and how it is suggested in either reference that solving the problems of frictional slip will also solve the problems of gravitational slip.

Moreover, if the Examiner wishes to assert that the motivation to combine such teachings is in the knowledge generally available to one of ordinary skill in the art, than the Applicant respectfully requests that the Examiner provide an affidavit to the same and/or take official notice thereof. Additionally, if the Examiner should provide such affidavit or take such official notice, than pursuant to MPEP 2144.03, the Applicant requests that the Examiner cite a reference in support of his position. More specifically the Applicant requests that the Examiner cite a reference that teaches or suggests that solving the problems of gravitational slip (as in Wingo) will also solve the problems of frictional slip (as in Inaba).


In view of the aforementioned, it is believed this application is now in condition for full allowance and such action at an early date is earnestly solicited.

It is believed that the foregoing remarks fully comply with the Office Action.

The Examiner is invited to contact Applicant's representative at the below-listed phone number with any questions.

Applicant believes no fee is due for this Response. However, should there be any deficiency in fees associated with the filing of this Response, please charge our Deposit Account No. 13-0235.

Respectfully submitted,

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Version with Markings to Show Changes Made

A marked-up version of the amendments are shown below showing additions with underlining and deletions between brackets.

In the Claims:

The replacement Claim 1 is as follows:

1. A wafer boat for supporting silicon wafers, the wafer boat comprising:
a ceramic body having at least one wafer support structure sized to support a silicon wafer thereon;
a ceramic coating disposed on a surface of the wafer support structure, the ceramic coating having an impurity migration preventing thickness and a wafer contact surface, the wafer contact surface having a post coating surface finish;
wherein the post coating surface finish of the wafer contact surface substantially prevents frictional slip in the silicon wafers and is less than or substantially equal to 1 micron; and
wherein the wafer contact surface is less than or substantially equal to 1/2 of the surface area of the wafer.

The replacement Claim 29 is as follows:

29. The wafer boat of Claim [28] 1 comprising:
a base;
a plurality of support rods extending generally upwards from the base, each support rod including at least one arm extending generally inwardly relative to the base, each arm having the post coating surface finish disposed thereon.

The replacement Claim 30 is as follows:

30. A wafer boat for supporting silicon wafers, the wafer boat comprising:
a ceramic body having at least one wafer support structure sized to support a silicon wafer thereon;
a ceramic coating disposed on a surface of the wafer support structure, the ceramic coating having an impurity migration preventing thickness and a wafer contact surface, the wafer contact surface having a post coating surface finish;
wherein the wafer contact surface is less than or substantially equal to $1/2$ of the surface area of the wafer, and the post coating surface finish substantially prevents frictional slip in the silicon wafer.



Memorandum

FROM	Richard R. Hengst
TO	Stephen P. Scuderi
COPY	M. Crosby
DATE	February 18, 2003

Subject: From Inventor Richard R. Hengst
Frictional Slip versus Gravitational Slip

Crystallographic slip in a single-crystal silicon wafer is caused by stress induced in the wafer. This is best described by the expression below:

$$\text{Stress}_{(\text{Total})} = \text{Stress}_{(\text{gravitational})} + \text{Stress}_{(\text{frictional})} + \text{Stress}_{(\text{thermal})}$$

To minimize wafer slip one must minimize Stress_(total). In this case Stress_(thermal) will be considered to be constant. Gravitational stress is used to describe the stress induced to the wafer in an attempt to support its own weight. When the wafer is not fully supported from underneath, the unsupported area creates a stress or bending moment in the wafer. This stress is proportional to the mass of the wafer. Typically the gravitational stress increases as the unsupported area of the wafer increases. Gravitational stress is not dependent upon the surface condition of the contact surface in the areas of support.

On the other hand, frictional stress is directly dependent on the condition of the contact surface of the support. As the wafer and contact surface are heated to the wafer processing temperature, these surfaces are undergoing differential thermal expansion. Therefore, these surfaces are in motion relative to each other. This relative motion (sliding) between the surfaces creates a frictional stress. By improving the surface finish of the support surface it is possible to reduce Stress_(frictional).

In summary, Stress_(gravitational) is best described as the stress induced to the wafer via the unsupported portion of the wafer. Stress_(frictional) is stress induced via the sliding of the wafer across the support surface.

Richard R. Hengst
Feb. 18, 2003